LAB 06

PROCEDURES & FILE HADILING

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EL 2003 COMP ORG & ASSEMBLY LANGUAGE LAB

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Lab Session 06: PROCEDURES & FILE HANDILING

Objectives:

- Built-in-Procedure
- PROC Directive
- Call & Ret Instructions
- File Handiling

Procedure in Irvine32 Library:

Some of the procedures available in Irvine32 library are:

1. **Clrscr:**
   Clears the console window and locates the cursor at the above left corner.
2. **Crlf:**
   Writes the end of line sequence to the console window.
3. **DumpRegs:**
   Displays the EAX, EBX, ECX, EDX, ESI, EDI, ESP:EIP and EFLAG registers.
4. **DumpMem (ESI=Starting OFFSET, ECX=LengthOf, EBX=Type):**
   Writes the block of memory to the console window in hexadecimal.
5. **WriteBin:**
   Writes an unsigned 32-bit integer to the console window in ASCII binary format.
6. **WriteChar:**
   Writes a single character to the console window.
7. **WriteDec:**
   Writes an unsigned 32-bit integer to the console window in decimal format.
8. **WriteHex:**
   Writes a 32-bit integer to the console window in hexadecimal format.
9. **WriteInt:**
   Writes a signed 32-bit integer to the console window in decimal format.
10. **WriteString (EDX= OFFSET String):**

Write a null-terminated string to the console window.

11. **ReadChar:**
    Waits for single character to be typed at the keyboard and returns that character.
12. **ReadDec:**
    Reads an unsigned 32-bit integer from the keyboard.
13. **ReadHex:**
    Reads a 32-bit hexadecimal integers from the keyboard, terminated by the enter key.
14. **ReadInt:**
    Reads a signed 32-bit integer from the keyboard, terminated by the enter key.
15. **ReadString (EDX=OFFSET String, ECX=SIZEOF):**
    Reads a string from the keyboard, terminated by the enter key.
16. **SetTextColor (Background= Upper AL, Foreground= Lower AL):**
    Sets the foreground and background colors of all subsequent text output to the console.
17. **GetTextColor (Background= Upper AL, Foreground= Lower AL):**
    Returns the active foreground and background text colors in the console window.
18. **MsgBox (EDX=OFFSET String, EBX= OFFSET Title):**
    Displays a pop-up message box.
19. **MsgBoxAsk (EDX=OFFSET String, EBX= OFFSET Title):**
    Displays a yes/no question in a pop-up message box.
20. **WaitMsg:**
    Display a message and wait for the Enter key to be pressed.
21. **Delay:**
    Pauses the program execution for a specified interval (in milliseconds).
22. **getDateTime:**
    Gets the current date and time from system
23. **GetMaxXY (DX=col, AX=row):**
    Gets the number of columns and rows in the console window buffer.
24. **Gotoxy (DH=row , DL=col):**
    Locates the cursor at a specific row and column in the console window. By default X coordinate range is 0-79 and Y coordinate range is 0-24.
25. **Randomize:**
    Seeds the random number generator with a unique value.

Color and Its Value							
Color	Value	Color	Value	Color	Value	Color	Value
Black	0	Red	4	Gray	8	Light Red	C
Blue	1	Magneta	5	Light Blue	9	Light Magenta	D
Green	2	Brown	6	Light Green	A	Yellow	E
Cyan	3	Light Gray	7	Light Cyan	B	White	h

Example 01:

Gotoxy (DH=row , DL=col):

Locates the cursor at a specific row and column in the console window. By default X coordinate range is 0-79 and Y coordinate range is 0-24.

```
Include Irvine32.inc
.code  main
proc   call
Clrscr
mov dh, 24
 mov dl, 79                          ; bottom-right corner
 call Gotoxy                         ; Move cursor there
mov al, '*'
 call WriteChar                      ; Write '*' in bottom right
 call ReadChar                       ; Character entered by user is in AL
mov dh, 10   mov dl, 10   call Gotoxy
 call WriteChar                       ; Output the character entered at 10,10
call CrLf                       ; Carriage return to line 11

 call DumpRegs                  ; Output registers
                                ; output a row of '&'s to the screen, minus first column
 mov al, '&'                    ; row 5
mov cx, 79
mov dh, 5  L1:
mov dl, cl
 call Gotoxy

 call
WriteChar
loop L1    call
CrLf   exit
main ENDP
END main
```

Here are some more:

Randomize	Initialize random number seed
Random32	Generate a 32 bit random integer and return it in eax
RandomRange	Generate random integer from 0 to eax-1

Example 02:

```
Include Irvine32.inc
.data
```

```
myInt DWORD ?  myChar
BYTE ?
myStr BYTE 30 dup(0)  myPrompt
BYTE "Enter a string:",0
myPrompt2 BYTE "Enter a number:",0
.code  main
proc
 ; Output 2 random numbers
  call Randomize                    ; Only call randomize once
  call Random32
  call WriteInt           call      ; output EAX as int
Crlf
call RandomRange
  call WriteInt                     ; output EAX as int
  call Crlf
  ; Get and display a string
mov edx, offset myprompt
  call Writestring                   ; Display prompt
  mov ecx, 30                        ; Max length of 30
mov edx, offset myStr
call Readstring
  call Writestring                  ; Output what was typed
  Call Crlf
  ; Get a number and display it
mov edx, offset myprompt2
  call Writestring                             ; Display prompt
  call ReadInt                               ; Int stored in
EAX   call Crlf   call WriteInt
  call Crlf

  exit
main endp  end
main
```

Example 03:

```
Include Irvine32.inc
.data
msg byte "Genrating 50 number",0
.code
```

```
main PROC mov
edx,offset msg call
WriteString
call crlf
mov ecx,50 L1:
mov eax,+33 call
RandomRange call
writeDec
call Crlf Loop
L1
exit
main endp
end main
```

Writing Procedures

You have already been defining your own procedures – the main procedure works just like any other procedure.

The format to define a procedure is:

```
<Procedure-Name> proc
…
… ; code for procedure
…
ret ; Return from the procedure
<Procedure-Name> endp
```

The keyword proc indicates the beginning of a procedure, and the keyword endp signals the end of the procedure. Your procedure must use the RET instruction when the procedure is finished. This causes the procedure to return by popping the instruction pointer off the stack.

To invoke a procedure, use call:
call procedure-name

Example 04: (Addition of Two Numbers)

```
INCLUDE Irvine32.inc
.data
var1 DWORD 5 var2
DWORD 6
.code
```

```
main PROC call
AddTwo
call writeint call
crlf
exit
main ENDP AddTwo
PROC
mov eax,var1 mov
ebx,var2
add eax,var2
ret
AddTwo ENDP
END main
```

Example 05: (Addition of Elements within an Array)

```
INCLUDE Irvine32.inc
.data
myarray DWORD 1,2,3,4,5,6

.code
main PROC
call ArraySum
call writeint call
crlf
exit
main ENDP
ArraySum PROC
mov esi,0 mov
eax,0
mov ecx, LENGTHOF myarray

L1:
 add eax,myarray[esi]
add esi,4
 Loop L1
ret
ArraySum ENDP
END main
```

FILING HANDLING

Creating a New File

EAX contains the newly created file’s handle or INVALID_HANDLE_VALUE if creation is unsuccessful.

Opening an Existing File

Offset of file name is passed to EDX. Handle of opened file is returned in EAX

Reading From a File

Call arguments:

EAX = an open file handle
EDX = offset of the input buffer
ECX = maximum number of bytes to read

Return arguments:

If CF = 0, EAX contains the number of bytes read. If
CF = 1, EAX contains a system error code.

Writing To a File:

Call arguments:

EAX = an open file handle
EDX = offset of the buffer
ECX = maximum number of bytes to write

Return arguments:

If CF = 0, EAX contains the number of bytes written.
If CF = 1, EAX contains a system error code.

Example 06

```
; Creating a File (CreateFile.asm)
INCLUDE Irvine32.inc
BUFFER_SIZE = 501
.data
buffer BYTE BUFFER_SIZE DUP(?)
filename BYTE "output.txt",0
```

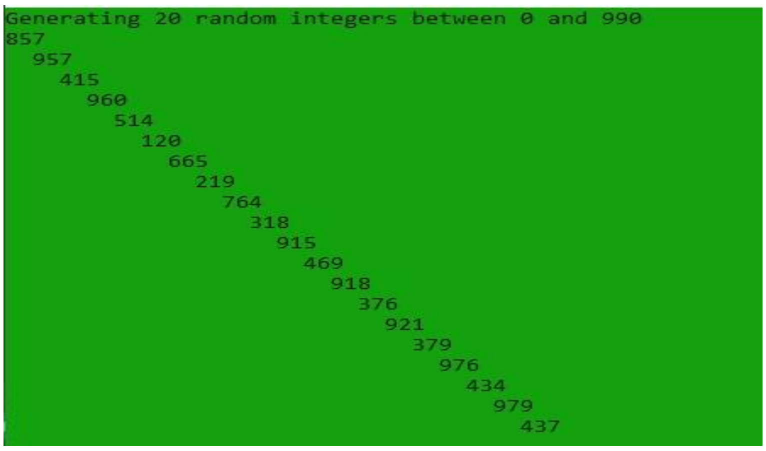
```
fileHandle HANDLE ? stringLength
DWORD ? bytesWritten DWORD ?
str2 BYTE "Bytes written to file [output.txt]:",0
str3 BYTE "Enter up to 500 characters and press"
 BYTE "[Enter]: ",0dh,0ah,0
.code
main PROC
; Create a new text file.
mov edx,OFFSET filename
call CreateOutputFile  mov
fileHandle,eax
; Ask the user to input a string.
 mov edx,OFFSET str3 ; "Enter upto ...."
call WriteString
 mov ecx,BUFFER_SIZE ; Input a string
mov edx,OFFSET buffer  call ReadString
mov stringLength,eax ; counts chars entered
; Write the buffer to the output file.
 mov eax,fileHandle
mov edx,OFFSET buffer
mov ecx,stringLength
call WriteToFile
 mov bytesWritten,eax ; save return value
 call CloseFile ; Display
the return value.
 mov edx,OFFSET str2 ; "Bytes written"
 call WriteString  mov
eax,bytesWritten  call
WriteDec  call Crlf

 exit
main ENDP
END main
```

<u>Example 07</u>

```
; Reading a File (ReadFile.asm)
; Opens, reads, and displays a text file using
; procedures from Irvine32.lib. INCLUDE
Irvine32.inc INCLUDE macros.inc
BUFFER_SIZE = 5000
.data
buffer BYTE BUFFER_SIZE DUP(?)
filename BYTE 80 DUP(0) fileHandle
HANDLE ?
.code
main PROC
; Let user input a filename.
 mWrite "Enter an input filename: "
 mov edx,OFFSET filename
 mov ecx,SIZEOF filename
call ReadString ; Open the
file for input.  mov
edx,OFFSET filename  call
OpenInputFile  mov
fileHandle,eax
; Read the file into a buffer.  mov
edx,OFFSET buffer  mov
ecx,BUFFER_SIZE  call ReadFromFile
mov buffer[eax],0 ; insert null terminator
mWrite "File size: "  call WriteDec ;
display file size
 call Crlf ; Display
the buffer.
 mWrite <"Buffer:",0dh,0ah,0dh,0ah>  mov
edx,OFFSET buffer ; display the buffer
 call WriteString
call Crlf mov
eax,fileHandle  call
CloseFile exit
 main ENDP
 END main
```

Lab Task(s):

1. Write a program to display a list of 20 random numbers in diagonal pattern. Add a 5 millisecond delay before displaying each number.



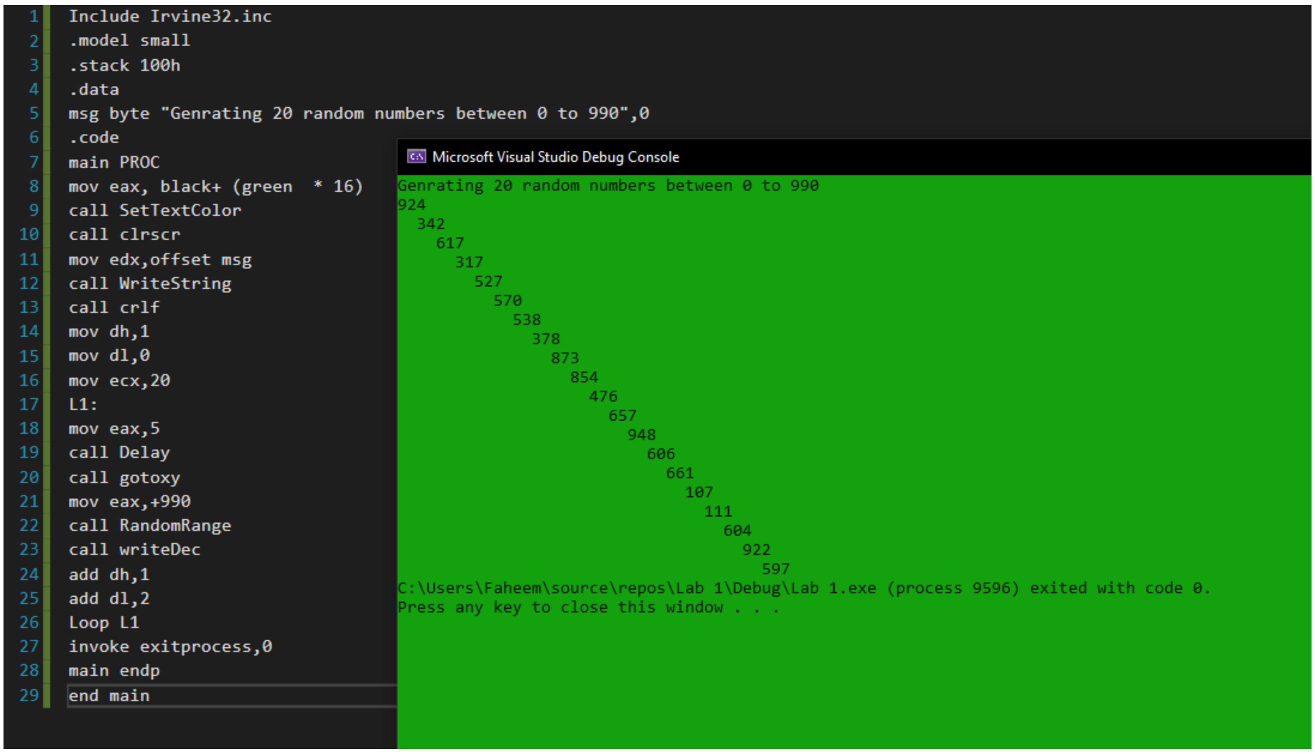
```
Generating 20 random integers between 0 and 990
857
  957
    415
      960
        514
          120
            665
              219
                764
                  318
                    915
                      469
                        918
                          376
                            921
                              379
                                976
                                  434
                                    979
                                      437
```

2. Write a progam to display a single character at 100 random screen locations, using a timing delay of 100 millisecond. **(Hint: Use GetMaxXY and movzx procedures)**

3. Write a program to generate 10 unsigned integers in the range 0 t0 4,294,967,294 and 10 signed integers in the range -50 t0+49.

4. Make a program to create a text file name MyFile.txt and write a string in file.

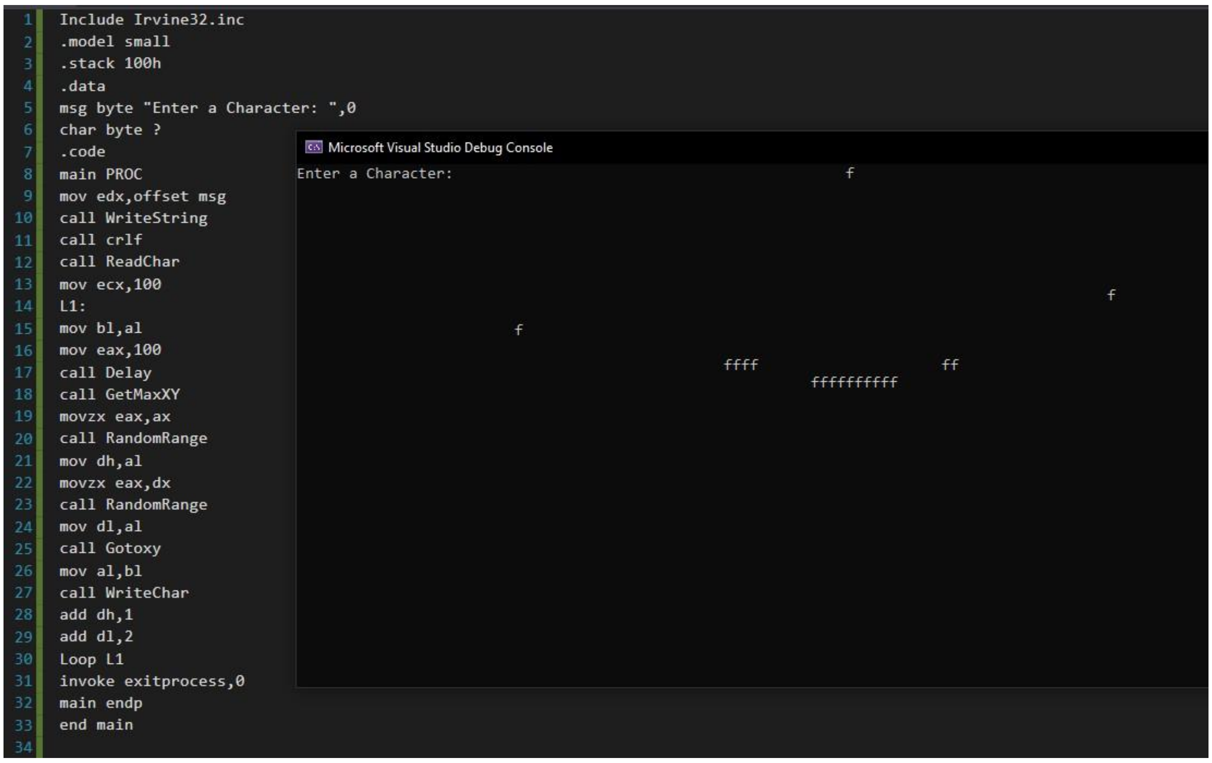
Task 1:



```
Include Irvine32.inc
.model small
.stack 100h
.data
msg byte "Genrating 20 random numbers between 0 to 990",0
.code
main PROC
mov eax, black+ (green  * 16)
call SetTextColor
call clrscr
mov edx,offset msg
call WriteString
call crlf
mov dh,1
mov dl,0
mov ecx,20
L1:
mov eax,5
call Delay
call gotoxy
mov eax,+990
call RandomRange
call writeDec
add dh,1
add dl,2
Loop L1
invoke exitprocess,0
main endp
end main
```

```
Genrating 20 random numbers between 0 to 990
924
  342
    617
      317
        527
          570
            538
              378
                873
                  854
                    476
                      657
                        948
                          606
                            661
                              107
                                111
                                  604
                                    922
                                      597
C:\Users\Faheem\source\repos\Lab 1\Debug\Lab 1.exe (process 9596) exited with code 0.
Press any key to close this window . . .
```

Task 2:

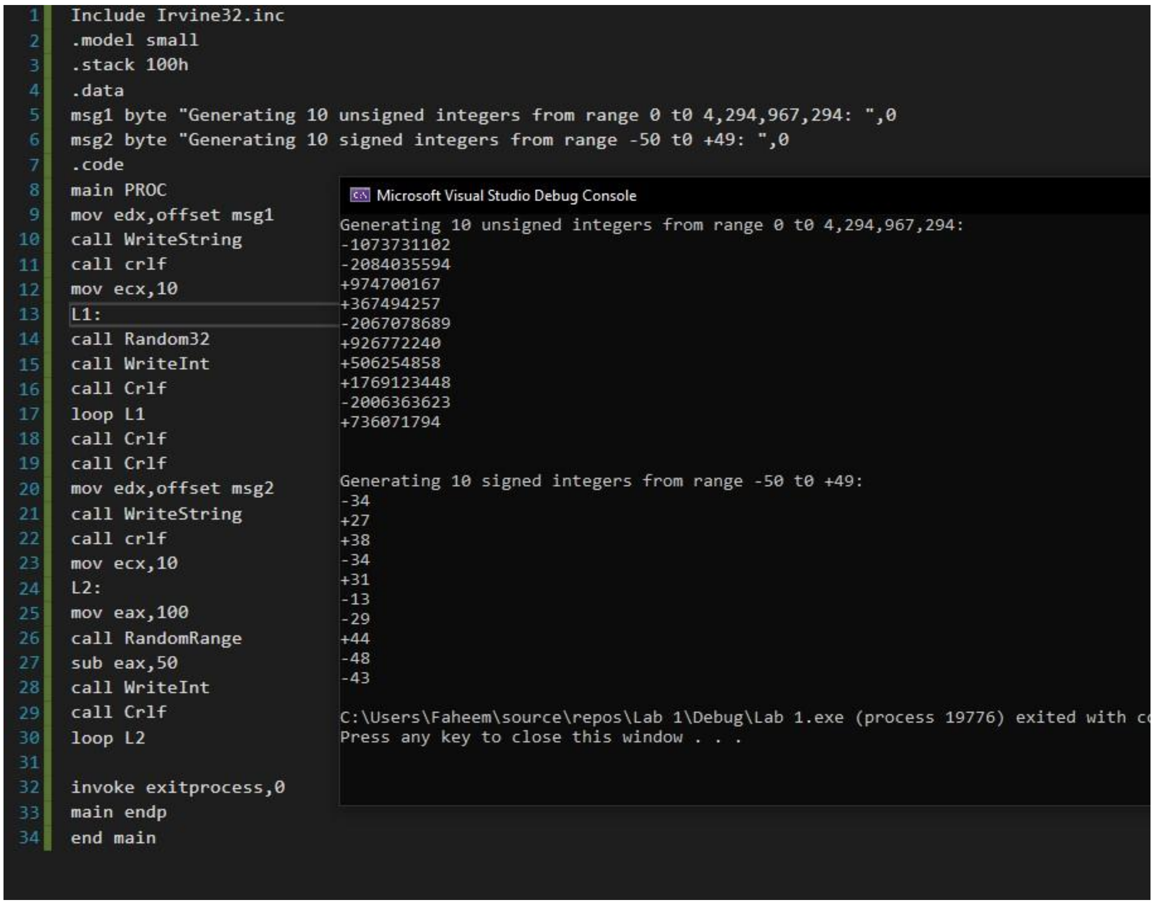


```
Include Irvine32.inc
.model small
.stack 100h
.data
msg byte "Enter a Character: ",0
char byte ?
.code
main PROC
mov edx,offset msg
call WriteString
call crlf
call ReadChar
mov ecx,100
L1:
mov bl,al
mov eax,100
call Delay
call GetMaxXY
movzx eax,ax
call RandomRange
mov dh,al
movzx eax,dx
call RandomRange
mov dl,al
call Gotoxy
mov al,bl
call WriteChar
add dh,1
add dl,2
Loop L1
invoke exitprocess,0
main endp
end main
```

Microsoft Visual Studio Debug Console

```
Enter a Character:                                         f



                                                                                       f
                       f
                                             ffff                    ff
                                                      ffffffffff
```

Task 3:

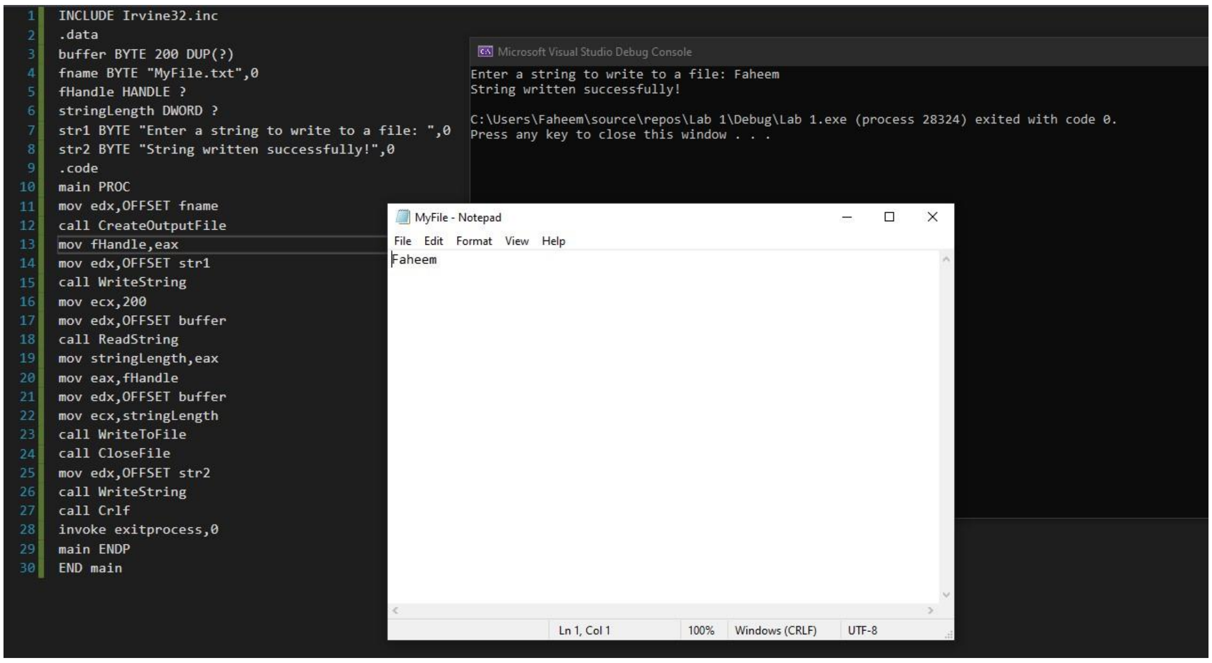


```
Include Irvine32.inc
.model small
.stack 100h
.data
msg1 byte "Generating 10 unsigned integers from range 0 t0 4,294,967,294: ",0
msg2 byte "Generating 10 signed integers from range -50 t0 +49: ",0
.code
main PROC
mov edx,offset msg1
call WriteString
call crlf
mov ecx,10
L1:
call Random32
call WriteInt
call Crlf
loop L1
call Crlf
call Crlf
mov edx,offset msg2
call WriteString
call crlf
mov ecx,10
L2:
mov eax,100
call RandomRange
sub eax,50
call WriteInt
call Crlf
loop L2

invoke exitprocess,0
main endp
end main
```

Microsoft Visual Studio Debug Console

```
Generating 10 unsigned integers from range 0 t0 4,294,967,294:
-1073731102
-2084035594
+974700167
+367494257
-2067078689
+926772240
+506254858
+1769123448
-2006363623
+736071794


Generating 10 signed integers from range -50 t0 +49:
-34
+27
+38
-34
+31
-13
-29
+44
-48
-43

C:\Users\Faheem\source\repos\Lab 1\Debug\Lab 1.exe (process 19776) exited with c
Press any key to close this window . . .
```

Task 4:



```
INCLUDE Irvine32.inc
.data
buffer BYTE 200 DUP(?)
fname BYTE "MyFile.txt",0
fHandle HANDLE ?
stringLength DWORD ?
str1 BYTE "Enter a string to write to a file: ",0
str2 BYTE "String written successfully!",0
.code
main PROC
mov edx,OFFSET fname
call CreateOutputFile
mov fHandle,eax
mov edx,OFFSET str1
call WriteString
mov ecx,200
mov edx,OFFSET buffer
call ReadString
mov stringLength,eax
mov eax,fHandle
mov edx,OFFSET buffer
mov ecx,stringLength
call WriteToFile
call CloseFile
mov edx,OFFSET str2
call WriteString
call Crlf
invoke exitprocess,0
main ENDP
END main
```

Microsoft Visual Studio Debug Console

```
Enter a string to write to a file: Faheem
String written successfully!

C:\Users\Faheem\source\repos\Lab 1\Debug\Lab 1.exe (process 28324) exited with code 0.
Press any key to close this window . . .
```

MyFile - Notepad

File Edit Format View Help

```
Faheem
```

Ln 1, Col 1 100% Windows (CRLF) UTF-8